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(58) Field of search

F4R  
H1D

(54) Multiple convoluted  
fluorescent lamp arrangements

(57) A fluorescent lamp unit is provided by mounting together convoluted discharge tubes of similar shape but different size. A specified example is the joining together of a 16 Watt and a 28 Watt 2D lamp. Suitable switching is provided whereby the 16W and 28W may be each on singly or together thus providing three light levels.

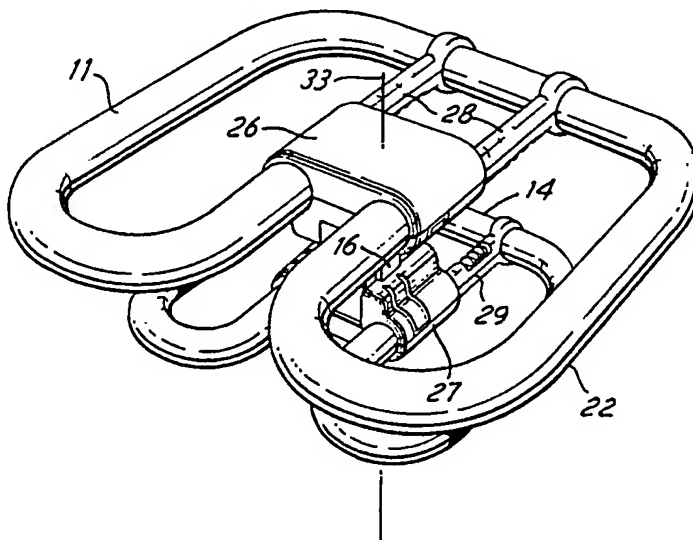
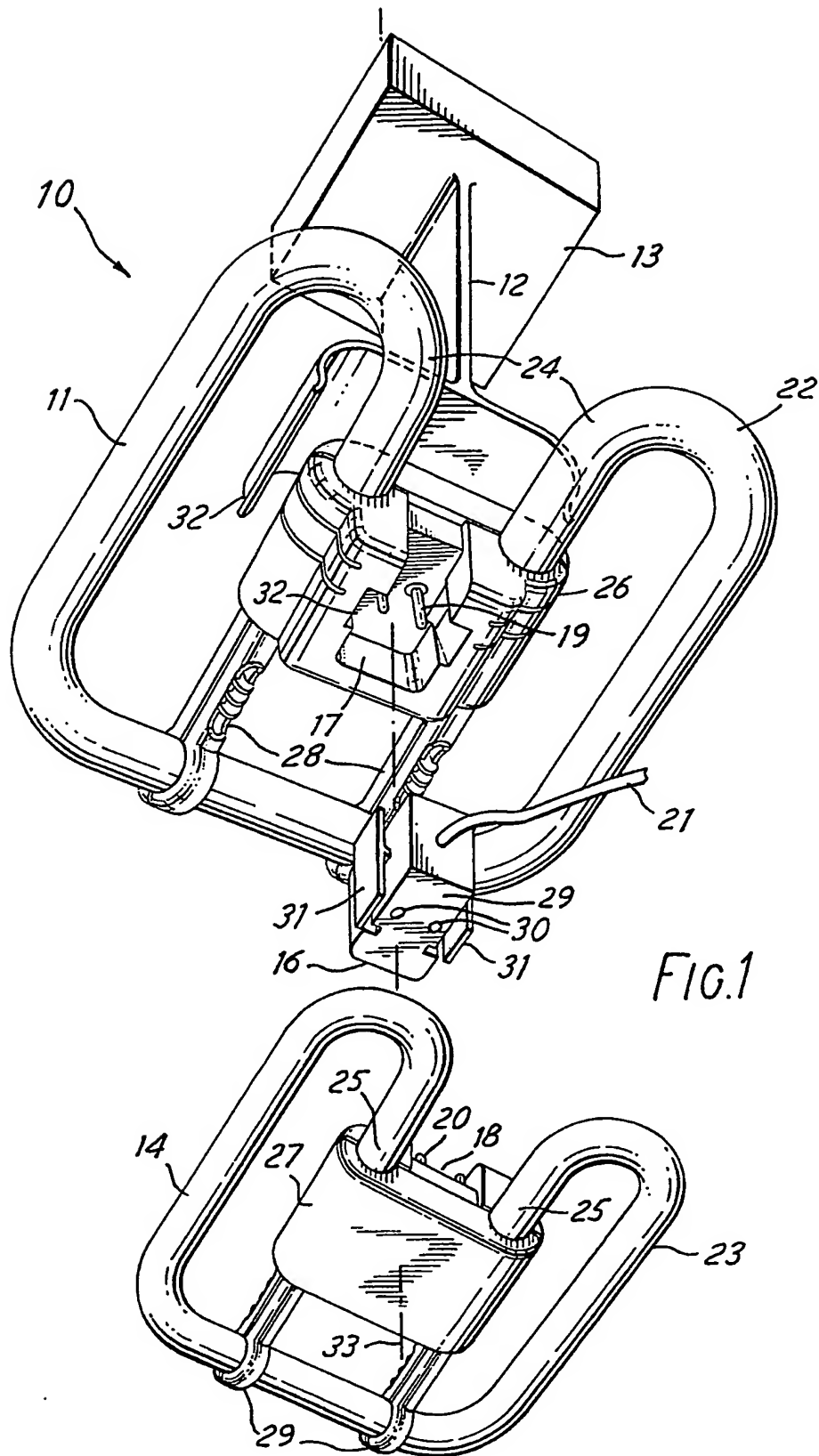


FIG. 2

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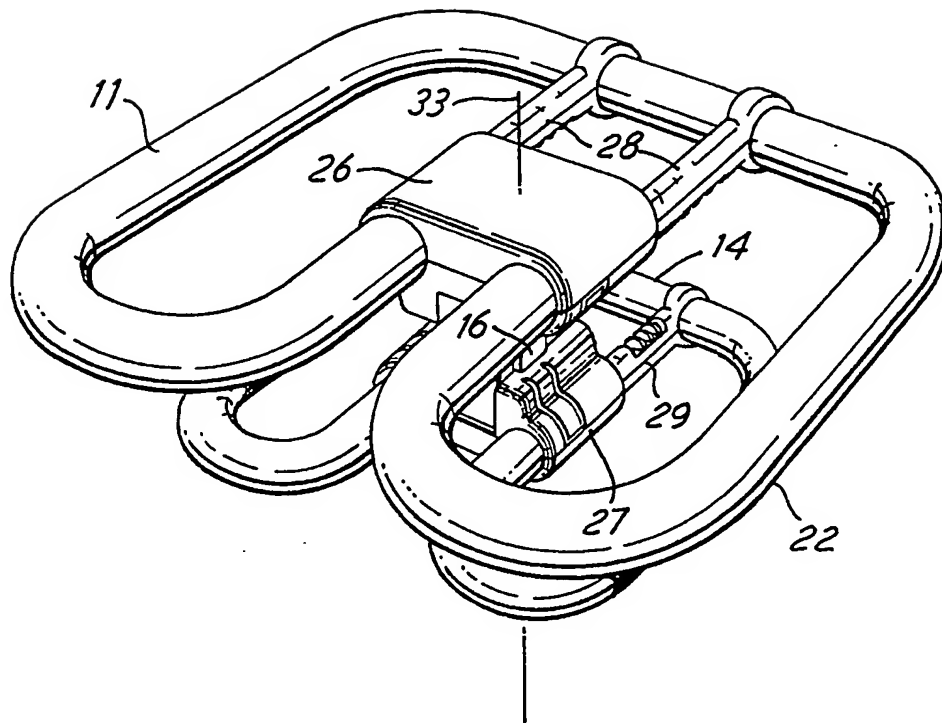
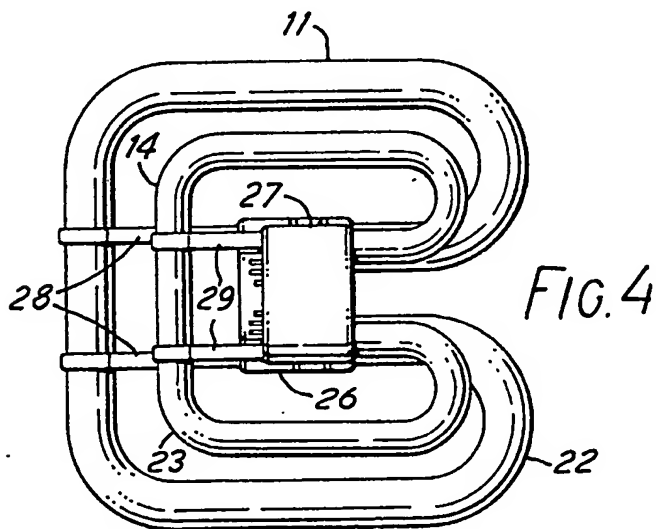
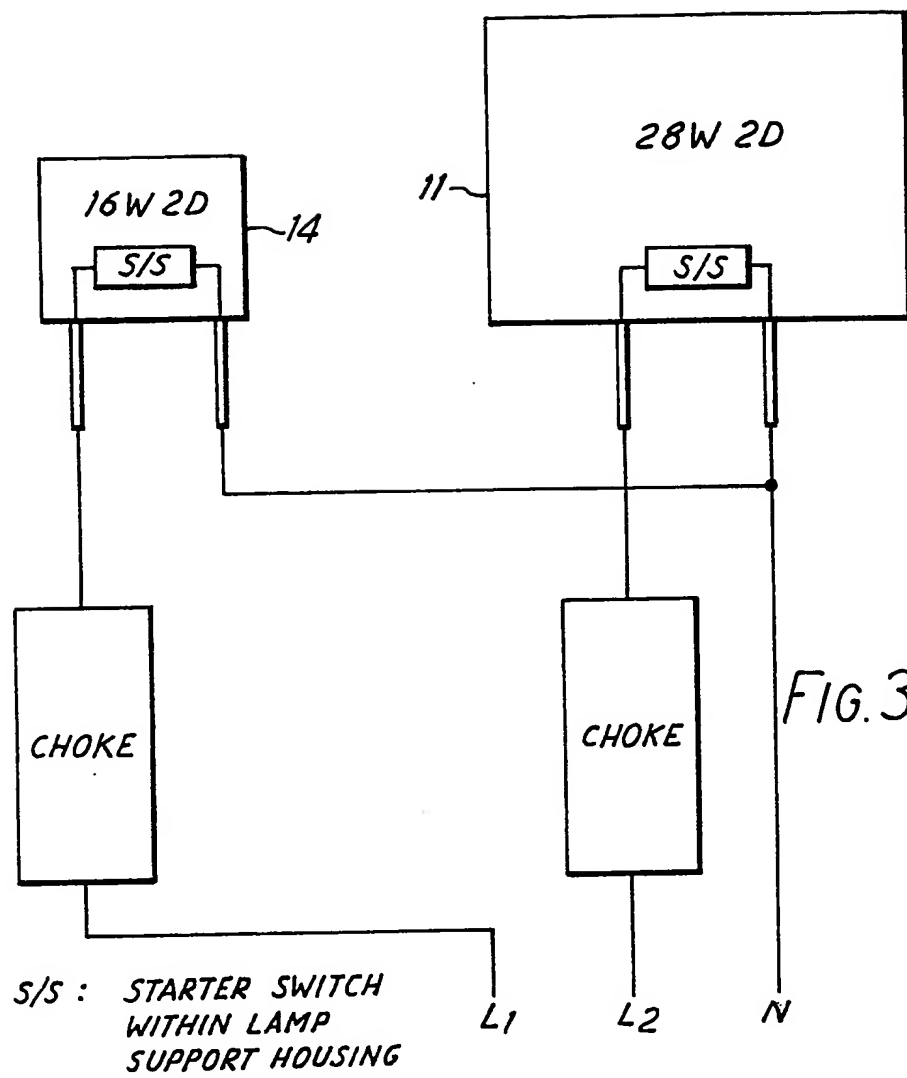


FIG. 2

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## SPECIFICATION

**Improvements in fluorescent lamp arrangements**

- 5 This invention relates to discharge lamps and in particular to fluorescent lamps of the type having a relatively lengthy discharge tube which is bent, folded or made otherwise into a  
10 convoluted shape so as to be more compact.

- In British Patent 1 582 885 there is disclosed a discharge lamp comprising a number of discharge tubes of convoluted shape. Each tube is spirally bent in opposite directions  
15 from the centre to the ends and each lamp comprises a minimum of two such tubes suspended from the ceiling in the manner of a chandelier. While the disposition of the discharge tubes in the manner disclosed results  
20 in an aesthetically pleasing design it is believed there must inevitably be some obscuration of the direct light paths from each tube thus contributing to the lowering of the efficiency of the arrangement.

- 25 In U.S. Patent 2 304 594 there is also disclosed a discharge lamp comprising a number of convoluted or folded discharge tubes. In one embodiment four discharge tubes are used disposed at ninety degrees to each other  
30 and each tube comprises very approximately a U-shape with the top of the U's being suspended from a central casing and with the overall effect also being somewhat similar to that of a chandelier. The outer leg of each U-shaped tube is stepped or zig zag shaped and  
35 both legs of the U lie in the same plane so that again there must be some obscuration of the direct light path from each tube. Another embodiment disclosed in U.S. Patent 2 304  
40 594 is a discharge lamp unit comprising a number of discharge tubes folded into a rectangular shape and having re-entrant ends which suspend each discharge tube from a horizontally disposed elongate central casing.  
45 Since each discharge tube is the same shape and size there will be considerable light obscuration in a direction along the horizontal axis of the casing.

- An object of this invention is to provide a  
50 discharge lamp comprising a number of convoluted or folded discharge tubes which lamp is less subject to the light obscuration problems referred to in the above mentioned prior art lamps. Moreover, there is an interest at the  
55 present time in lamps with energy saving facilities, for example, lamps with a facility for switching to different light levels to suit different ambient conditions. A further object of this invention is to provide a lamp capable of  
60 providing different light levels.

- In our European Patent Application No. 82300112, published 18th August, 1982, there is disclosed an improved fluorescent lamp comprising a discharge tube folded into  
65 a rectangular shape and including a lamp

- support housing generally lying within a zone defined substantially by the rectangular outline of the discharge tube. The discharge tube ends are re-entrant into the lamp support housing which also forms a control box containing the electrical connections for the lamp.  
70 At least one lamp support arm provides relative support between the lamp support housing and the discharge tube so that the lamp  
75 may be easily handled in the manner of a general lighting service incandescent lamp. Such a fluorescent lamp has become well known in the art as a 2D lamp and will be referred to hereinafter as a 2D lamp.

- 80 According to one aspect of the invention there is provided a fluorescent lamp unit comprising a plurality of convoluted discharge tubes defining similar shapes each lying substantially in a respective plane, each tube  
85 being disposed about a common axis and the plane in which each said discharge tube lies being substantially normal to said axis, the discharge tubes being of different size and disposed relative to each other whereby a  
90 fluorescent lamp is provided which is capable, in use, of providing different light levels.

- According to another aspect of the invention there is provided a fluorescent lamp unit comprising a plurality of convoluted discharged tubes bent to define similar shapes each lying substantially within a respective plane, each tube being disposed about a common axis and the plane in which each  
95 said discharge tube lies being substantially normal to said axis, the discharge tubes being of different size and disposed nested relative to each other, the tubes being arranged for selective operation whereby a fluorescent lamp is provided which is capable, in use, of  
100 providing different light levels.

- According to a further aspect of the invention there is provided a lamp holder adapted to receive two 2D fluorescent lamps connected in opposing dispositions with their  
110 respective lamp support housings substantially in register and to provide electrical connection thereto.

- For ease of manufacture the discharge tubes are preferably bent from a single length  
115 of tube.

- The invention will now be described by way of example and with reference to the accompanying drawings wherein

- 120 *Figure 1* is an exploded view of various components of one embodiment of a lamp according to the invention,

- Figure 2* is a perspective view of a lamp according to the invention,

- 125 *Figure 3* is a circuit diagram for operation of a lamp according to the invention, and

- Figure 4* is a plan view showing discharge tubes nested within each other in accordance with the invention.

- In Fig. 1 various components of a discharge  
130 lamp 10, for example a fluorescent lamp, are

shown comprising a first 2D lamp 11 carried by a spring clip 12 of metal or plastics material attached to a control or ballast box 13. A second smaller 2D lamp 14 is connected to the first and larger 2D lamp 11 by means of a common lamp holder 16. The lamp holder 16 fits within recesses 17, 18 on the first and second 2D lamps respectively. Electrical connection to the lamp holder is made by means of terminal pins 19, 20 within recesses 17, 18 respectively and control cable 21.

It should be noted that the 2D lamps mentioned above are described in greater detail in the specification of our afore-mentioned European Patent Application No. 82300112 and reference may be had to this document for a more detailed description of a 2D lamp. Suffice it to say each lamp comprises a discharge tube 22, 23 folded into a rectangular, preferably a square shape and with tube ends 24, 25 re-entrant into the square zone defined by the remainder of the discharge tube. The ends 24, 25 are received respectively within lamp support housing 26, 27 which are made of plastic material. Lamp support arms 28, 29 extend from each lamp support housing 26, 27 and surround each discharge tube, 22, 23 respectively thus providing relative support between each discharge tube and its respective lamp support housing. Although the outer dimensions of each lamp support housing 26, 27 are not exactly the same, they are sufficiently in register to ensure that the recess 17, 18 and terminal pins 19 and 20, which are the same, line up to accommodate the common lamp holder 16 which, in effect, forms a coupling between the two 2D lamps 11 and 14. The lamp holder 16 has a T-shaped main body member 29. In addition to the terminals 30 (two per side) the main body member includes spring flaps 31 which fit into slots 32 in each of the recesses 17, 18. Each 2D lamp is therefore resiliently and releasably held by means of the common lamp holder 16. The spring clip 12 has a resilient flange member 32 which clips over the lamp support housing of the larger 2D lamp 11. From Fig. 1, therefore it will be clear that the lamp 10 may be assembled by mounting together 2D lamps 11 and 14 by means of common lamp holder 16 and the larger 2D lamp 11 being attached to the control box 13 by means of clip 12. Each 2D lamp lies in its respective plane substantially at right angles to main lamp axis 33 which will usually but not necessarily be vertically oriented. A suitable down lighter luminaire or uplighter (not shown) will enclose the lamp 10. It will be appreciated that the embodiment of Fig. 1 is particularly advantageous in that it allows for easy replacement of any of the component parts of the lamp 10.

In Fig. 2 there is shown an embodiment of the invention which differs from the embodi-

ment shown in Fig. 1 only in that lamp support housings 26, 27 are joined to common lamp holder 16. This may be done simply by applying a suitable adhesive between the mating surfaces. Alternatively the components may be joined by heating to fuse the plastic material.

It will be appreciated that a particular advantage of the embodiments described is that the resulting lamp 10 employs two standard 2D lamps 11 and 14. Thus three product lines become available where in fact, production is geared to only two product lines.

A further aspect of the invention is best described with reference to Fig. 3. Fig. 3 is a circuit diagram of the electrical connections of the lamp 10 showing how the connections are arranged so that 2D lamp 14 may be on only, or 2D lamp 11 may be on only, or both 2D lamps may be on together for simultaneous operation. This means, in effect, that three light levels are obtainable depending on the selected operation.

Fig. 4, illustrates how the different sized but similar shaped 2D lamps are disposed relatively to each other so that the perimeter of the discharge tube 23 of the smaller 2D, 14 fits conveniently within the rectangular, preferably square zone formed substantially by the perimeter of the discharge tube 22 of the larger 2D lamp 11. Discharge tubes disposed in this fashion can be said to be 'nested'. Surprisingly little or no drop in light levels is experienced due to light obscuration even though as seen in in plan view of Fig. 4, there is some masking effect of the re-entrant portions of the discharge tubes. If desired the re-entrant ends 25 of the smaller 2D lamp may be displaced so that they lie within and clear of the re-entrant ends of the larger 2D lamp. In this case no obscuration would take place in the plan view also in this case, the discharge tubes could be disposed in the same plane in which case there would be obscuration in elevation.

In a lamp 10 according to one embodiment of the invention a 16W and 28W 2D lamp is used. The 16W comprises a 15mm glass tube formed into an approximate square of 140mm while the 28W lamp comprised a 19mm glass tube formed into an approximate square shape of 205mm. The width dimension centre to centre of the glass tubes in the assembled lamp is 47mm. A suitable phosphor is applied to the inside of each glass tube.

It will be appreciated that the invention is not limited to the combination of these two specific lamps or shape of lamp.

## 125 CLAIMS

1. A fluorescent lamp unit comprising a plurality of convoluted discharge tubes defining similar shapes each lying substantially in a respective plane, each tube being disposed about a common axis and the plane in which

each said discharge tube lies being substantially normal to said axis, the discharge tubes being of different size and disposed relative to each other whereby a fluorescent lamp is

- 5 provided which is capable, in use, of providing different light levels.

2. A fluorescent lamp unit according to Claim 1 wherein each discharge tube has a central support housing, the support housings  
10 being substantially in register.

3. A fluorescent lamp unit according to Claim 2 wherein the support housings are joined by fusing or by an adhesive.

4. A fluorescent lamp unit according to  
15 Claim 2 wherein the support housings are releasably joined together.

5. A fluorescent lamp unit according to Claim 4 wherein the support housings are releasably joined by a common lamp holder.

20 6. A fluorescent lamp unit according to Claim 1 comprising two similar shaped discharge tubes having switched controls whereby the tubes may be individually or simultaneously energised to provide three  
25 available light levels.

7. A fluorescent lamp unit according to Claim 2 wherein at least a support arm extends between each respective discharge tube and its support housing.

30 8. A fluorescent lamp unit according to any preceding claim comprising two 2D fluorescent lamps, each said 2D lamp being similar in shape but different in size and having respective lamp support housings substantially  
35 in register, the lamps being arranged so that the zone defined substantially by the rectangular outline of one 2D lamp is clear of the zone defined substantially by the rectangular outline of the other 2D lamp.

40 9. A fluorescent lamp unit according to Claim 1 wherein the discharge tubes lie in the same plane.

10. A fluorescent lamp unit comprising a plurality of convoluted discharged tubes bent  
45 to define similar shapes each lying substantially within a respective plane, each tube being disposed about a common axis and the plane in which each said discharge tube lies being substantially normal to said axis, the  
50 discharge tubes being of different size and disposed nested relative to each other, the tubes being arranged for selective operation whereby a fluorescent lamp is provided which is capable, in use, of providing different light  
55 levels.

11. A fluorescent lamp unit substantially as herein described with reference to any of Figs. 1, 2, 3 or 4 of the accompanying drawings.